

Scope of knowledge regarding administration of oxygen therapy among firefighter rescue teams from Volunteer Fire Departments (OSP)

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Summary:

Introduction. A fire brigade is often the first rescue service at the scene of an accident. Until arrival of emergency medical services securing casualties, including oxygen supplementation to those who require it, remains the responsibility of firefighters.

Aim of the study. To evaluate the knowledge regarding administration of oxygen therapy to accident victims among firefighter rescue teams.

Material and methods. The study was conducted in 2011 and included 100 firefighters working in Volunteer Fire Departments in the area of mazovian and lodzkie provinces. We used questionnaires and statistical methods.

Results. Almost 60% of respondents knew when to use the oropharyngeal tube. As much as 61% were able to indicate that a passive oxygen therapy set is included in a PSP R1 kit. Knowledge on the following issues was inadequate: time designated to assessment of patient's respiratory rate (43%), definition of saturation (30%), causes of unreliable pulse oximetry results (25%), proper adult ventilation volume using a self-inflating ambu bag (15).

Conclusions. Due to the specific nature of firefighter rescue teams' work, evaluation of knowledge on principles of oxygen therapy is justified, as it may influence patient survival. Knowledge of firefighter rescue teams on patient oxygen supplementation is inadequate.

Key words: firefighter, medical response, oxygen, casualty, knowledge.

Introduction

Fire Department is unquestionably the leading rescue service in Poland. Authors' own experience shows that, in some situations, State or Volunteer Fire Department teams arrive at the scene of the event before medical emergency response teams. We have to realize that every minute of delay in providing aid, even at a basic level, to the victim reduces the chances

of recovery [1, 2]. Firefighter rescue teams, due to the actions they perform, are trained in providing first aid. Training programs also include principles of administering oxygen therapy to the patients who need it [3]. Supplementation of oxygen via nasal cannula and assisted breathing using a self-inflating (resuscitation) ambu bag are only some of the major methods

of administrating oxygen therapy by firefighter teams.



Figure 1: Self-inflating ambu bag with reservoir.

Unfortunately, literature lacks scientific reports on the problem of education of firefighter rescue teams on application of oxygen therapy to accident casualties. Therefore, it seems important to conduct research on the level of knowledge regarding oxygen supplementation among fire department rescue teams.

Aim of the study

The goal was to assess the level of education on oxygen therapy administration to accident victims among firefighter rescue teams working in Voluntary Fire Departments.

Material and methods

Study included a group of 100 people working in Volunteer Fire Departments in the region of mazovian and lodzkie provinces. Our research tool consisted of author's self-prepared questionnaire, which included 15 questions evaluating the level of knowledge of oxygen therapy among firefighter rescue teams working in Volunteer Fire Departments. The study was conducted in the fourth quarter of 2011.

Research data were encoded in Excel and compiled using statistical software STATISTICA 8.0. Normality of distribution of variables was tested using significance level indicated by p-value for Kolmogorov-Smirnov test. In case of normal distribution we used a t-student test to analyze mean differences. Results were considered statistically significant for p-value < 0.05.

Results

Men predominated among 100 of questioned subjects. They constituted 85% of cases (n=85). Fifteen percent of respondents were women (n=15; p<0.001). Mean age in the study group was 28.43 ± 5.53 years. There were 40 people aged 20-24 years, 42 subjects in the 25-29 age group, 11 respondents were aged 30-34 years, 4 were between 35 and 39 years old and there were 3 persons in the 45-49 age group. There were no respondents 40-44 years of age.

Figure 2 presents how firefighter rescue teams self-evaluated their level of knowledge of oxygen therapy. In this question, respondents were supposed to assess the level of knowledge of oxygen therapy using a five-point scale, where „1” indicated no knowledge and „5” meant excellent knowledge.

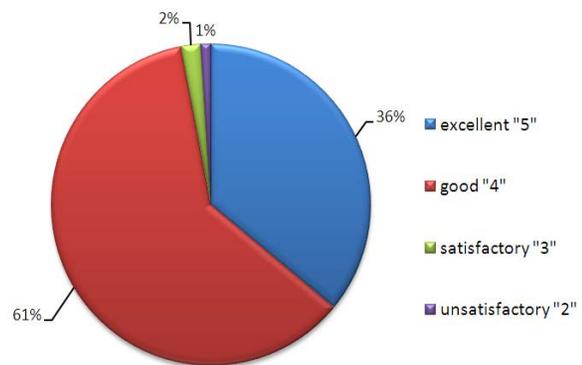


Figure 2: Self-evaluation of knowledge regarding oxygen therapy performed by firefighter rescue teams.

Level of knowledge, according to self-evaluation, was high and the score amounted to 4.32 ± 0.56 pts. As many as 36 of questioned respondents considered their knowledge excellent and 61 evaluated it as good, 2 as satisfactory and 1 person rated it unsatisfactory. No one chose an answer „1”, which indicated lack of knowledge. There was a great disparity between self-assessed knowledge and the results of the objective evaluation test (Fig. 2).

Figure 2 presents a comparison of good and wrong answers on a test expressed in percentages. Only 35% of all answers were correct.

Question 1. In the first question respondents were asked to indicate the values of oxygen concentration that can be achieved through a face mask

with reservoir. Only 35% of respondents pointed to the correct answer – „100%”.

Question 2. This question inquired what kind of oxygen therapy is provided through nasal cannulas. In this case, nearly a half of respondents (46%) gave correct answers by indicating passive oxygen therapy.

Question 3. This question asked respondents to point to indications for oxygen therapy. Of all respondents, 32 persons were able to choose correct indications for administration of oxygen therapy to patients during a rescue operation.

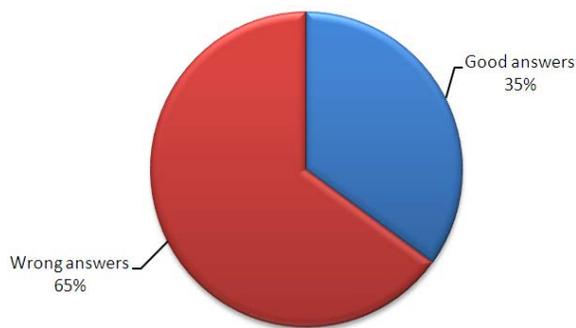


Figure 3: Assessment of knowledge regarding oxygen therapy among firefighter rescue teams

Question 4. In this question respondents were supposed to answer by what percentage the concentration of oxygen in the breathing mixture raises for every 1 l/min of increased oxygen flow through nasal cannulas. Only 11% of all respondents gave correct answers ($p < 0.001$).

Question 5. Firefighter rescue teams were asked to identify which emergency kit includes a passive oxygen therapy set. Sixty-one percent correctly indicated the PSP R1 kit. Distribution of provided answers is presented in Figure 3.

Question 6. In the entire studied group 52% of respondents were not able to tell the distance used for fitting of the oropharyngeal tube. The correct answer „the distance from incisors to the angle of jaw” was indicated by only 48% of subjects.

Question 7. This question was also related to the use of oropharyngeal tube. The respondent was asked to indicate the state, in which this instrument may be applied for restoring airway patency. Subjects could choose from the following answers: „confused patient,” „somnolent

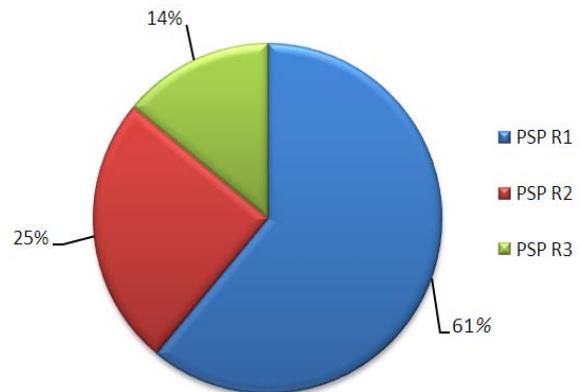


Figure 4: Answers provided by respondents to question 5.

patient” and „deeply unconscious patient.” The majority of respondents, as much as 59%, answered correctly that oropharyngeal tube should be only used in case of deeply unconscious patients.

Question 8. From all available answers („using suction to aspirate fluid content from oral cavity,” „passive oxygen therapy,” and „inserting an oropharyngeal tube”) participants were to point to the action, which is not a part of the procedure of establishing airway patency. Forty-three subjects correctly indicated „passive oxygen therapy,” while 57 people gave wrong answers ($p < 0.001$).

Question 9. This question was designed to test respondent’s knowledge of the use of a self-inflating ambu bag. The respondent was supposed to identify an incorrect statement regarding an ambu bag. Correct answer – „a self-inflating ambu bag allows for achieving maximum oxygen concentrations of 75%” – was given by 46% of respondents.

Answer 10. Similar to the previous question, this one was related to the use of self-inflating ambu bag. Respondents were supposed to indicate the proper ambu bag ventilation volume in an adult. The correct answer was 500-700 ml and it was given by only 15% of respondents ($p < 0.001$).

Question 11. Cardiopulmonary resuscitation is one of the most stress-inducing experiences a firefighter may come in contact with. In this question, the respondent was to indicate the time required for assessment of patient’s breathing according to current guidelines. Thirty-nine subjects answered correctly „10 seconds” ($p < 0.001$).

Question 12. In the twelfth question we asked respondents about the meaning of the term „saturation.” Only 30% of them were able to identify saturation as blood oxygen concentration. As much as 70% of subjects gave wrong answers. A detailed distribution of answers given by respondents is depicted in Figure 4.

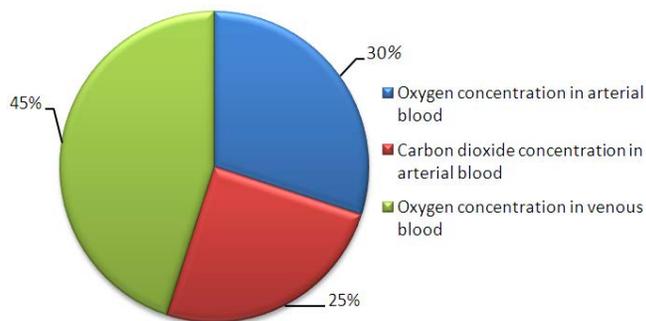


Figure 5: Answers provided by respondents to question 12.

Question 13. This question also referred to assessment of saturation level. Among the provided answers („carbon monoxide poisoning,” „cyanide poisoning,” „hyperthermia”) respondents were to choose the state, in which saturation measurement would be unreliable. Only 25% gave a correct answer, while 75 people responded incorrectly.

Discussion

Oxygen, an element necessary for human existence, is also used as a drug [4, 5, 6]. Just like in any other case of drug administration, supplementation of oxygen should be given according to indications and with careful dosing. For that purpose firefighter rescue teams, who are often the ones to administer first aid to victims before arrival of medical emergency services, undergo first aid training. First aid course, which lasts 66 hours (involving 25 hours of theory and 41 hours of practical training), includes issues related to supplementation of oxygen therapy to casualties [3].

Unfortunately, there are no reports in the literature on the problem of knowledge regarding principles of oxygen therapy among firefighter rescue teams. Therefore, it is not possible to compare our results to those obtained by other authors.

The level of self-confidence among firefighters from the studied group was high and amounted

to 4.32 points. There was a great disparity between their self-evaluated knowledge and test results, as evidenced by a 61% rate of incorrect answers given by respondents. At this point, it is safe to say that members of firefighter rescue teams overstate their knowledge of oxygen therapy administration.

At the scene of rescue operation firefighter rescue teams may administer oxygen therapy to the patient according to first aid procedures. Oxygen therapy may be divided into passive and active types [7]. In passive therapy oxygen is inhaled due to patient’s preserved ventilatory function, while in case of active oxygen therapy forced ventilation (replacement breathing) is used [7, 8]. In our material, only 46% of respondents knew the difference between methods of passive and active oxygen therapy, as demonstrated by indicating patient ventilation via nasal cannulas as an element of passive oxygen therapy.

Symptoms of hypoxia include: skin cyanosis (if deoxygenated hemoglobin concentration falls below 5 g/l) [4, 8]. Moreover, we may observe excessive respiratory muscle work, which is a sign of dyspnea. In case of central nervous system hypoxia patient may be restless or aggravated. Severe hypoxia may be associated with loss of consciousness. The simplest, non-invasive method of evaluating the level of blood oxygen saturation at the site of rescue operation is pulse oximetry. Only 30% of respondents in our study group possessed the knowledge that saturation is a measure of oxygen content in arterial blood.

Despite pulse oximetry being a routinely used method of saturation measurement, in some situations this measurement may be unreliable (erroneous). An example of such situation is carbon monoxide poisoning. As carbon monoxide has almost 250-fold greater affinity to hemoglobin than oxygen, bonds created as a result of coupling of hemoglobin with carbon monoxide and carboxyhemoglobin formation are extremely strong. It leads to tissue hypoxia. In the above situation, pulse oximeter may show normal values despite the true level of arterial blood oxygenation being significantly lower. Carbon monoxide poisoning is dangerous, as the most susceptible organs such as the cardiovascular system and central nervous system are damaged first. In severe carbon

monoxide poisoning therapy in a hyperbaric chamber is the treatment of choice [9]. From our study group, 25% of subjects were familiar with situations, in which pulse oximetry could be unreliable. Due to the possibility of airway obstruction, manual methods of establishing airway patency applied first and followed by instrumental methods, firefighter rescue teams should possess the knowledge of oropharyngeal tube insertion. Guedel tube is supposed to prevent tongue slipping toward the posterior pharyngeal wall and causing airway obstruction. A tube that is either too large or too small may cause obstruction; hence it is important to know how to choose a proper one. Size of the tube should be fitted to each particular patient by placing the tube against patient's cheek. Tube collar (at the inlet) should be located near the incisors, while its end should reach mandibular angle. A tube fitted in such manner ensures airway patency, but does not

prevent from regurgitation – passive movement of stomach contents into the esophagus without a gag reflex – or from vomiting. Fifty-two percent of respondents knew how to appropriately fit an oropharyngeal tube. A rescue worker should remember that oropharyngeal tube should only be used in deeply unconscious victims. Most of the surveyed firefighters were familiar with this principle, as much as 59% answered correctly.

Conclusions

Due to the character of firefighter rescue teams' work, it is justified to examine the knowledge regarding administration of oxygen therapy among firefighters, as it may influence patient survival.

Knowledge of oxygen therapy among firefighters is inadequate.

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